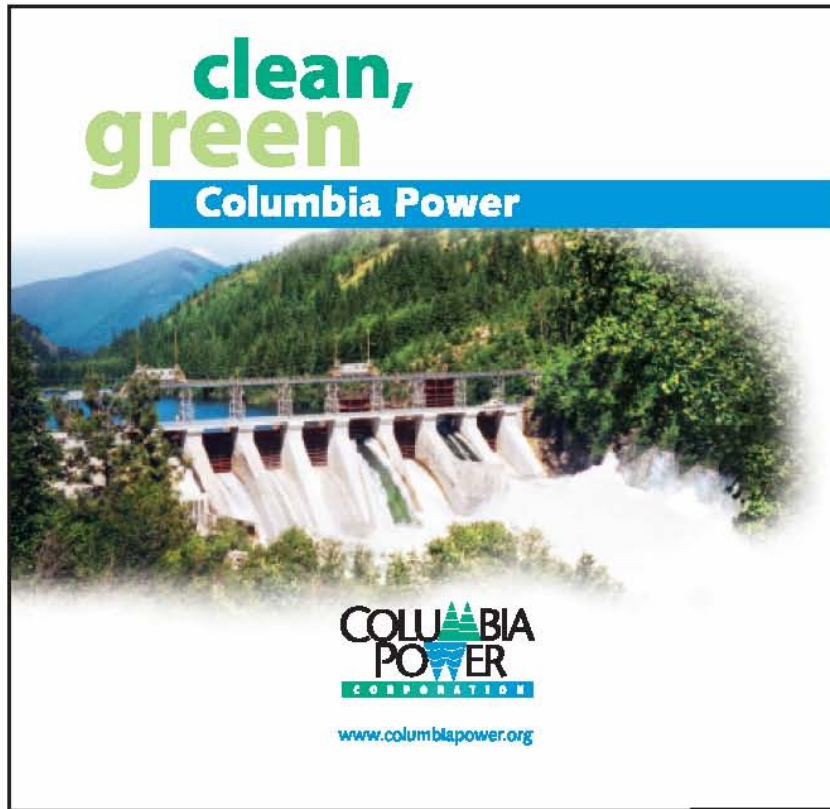


# Waneta Expansion Project



Presented by  
Llewellyn Matthews  
To Transboundary  
Gas Group  
April 28, 2004

# Pend d'Oreille River System

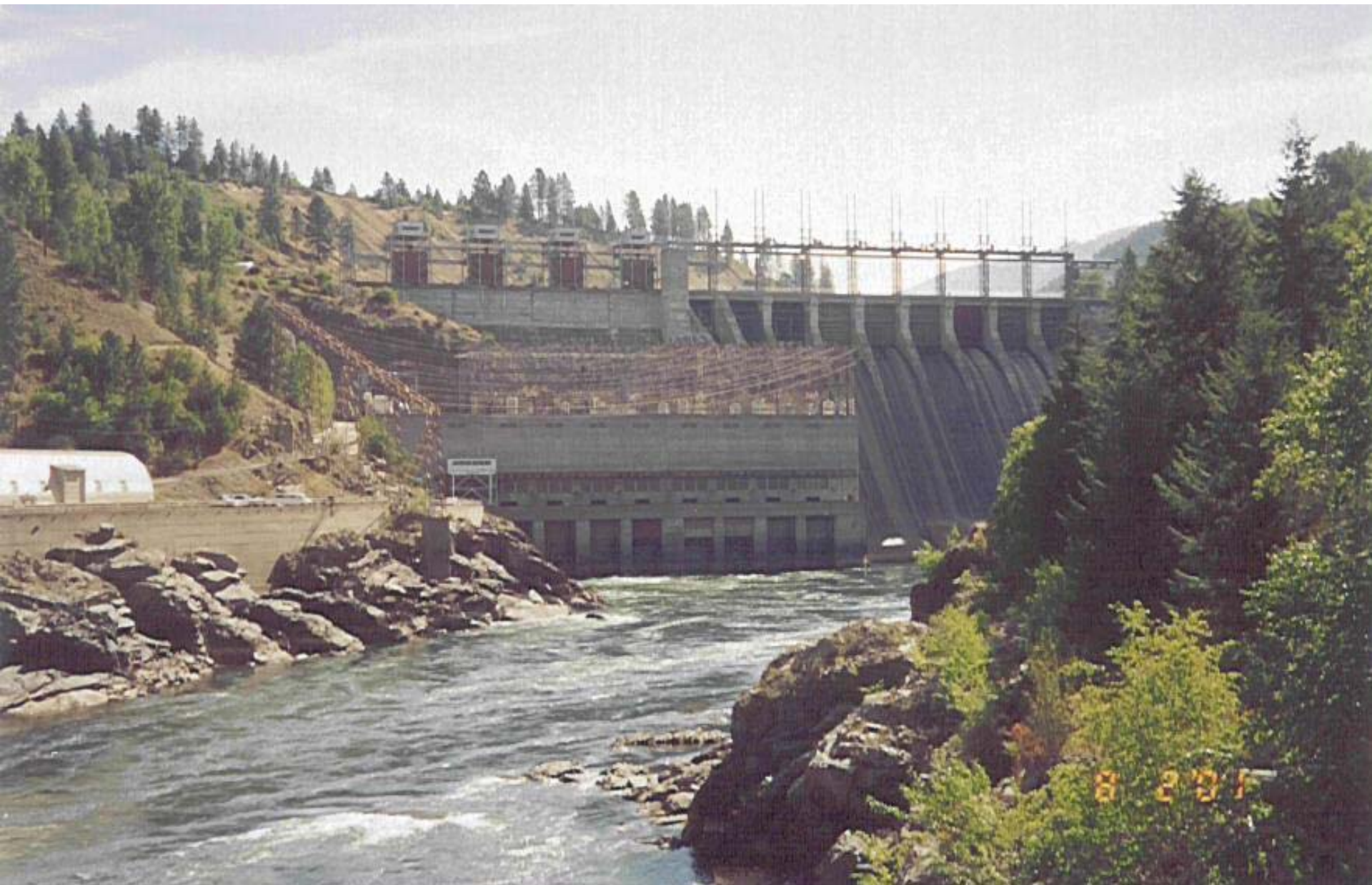
## Waneta Expansion Project:

- 27 km downstream of Seattle City Light's Boundary Dam
- 9 km downstream of BC Hydro's Seven Mile Dam
- Adjacent to Waneta Dam



Plant	Number of Units	Capacity (m <sup>3</sup> /s)
Boundary	6	1420
Seven Mile	4	1465
Waneta (no upgrades)	4	708
Waneta (with upgrades)	4	934

# Waneta Dam

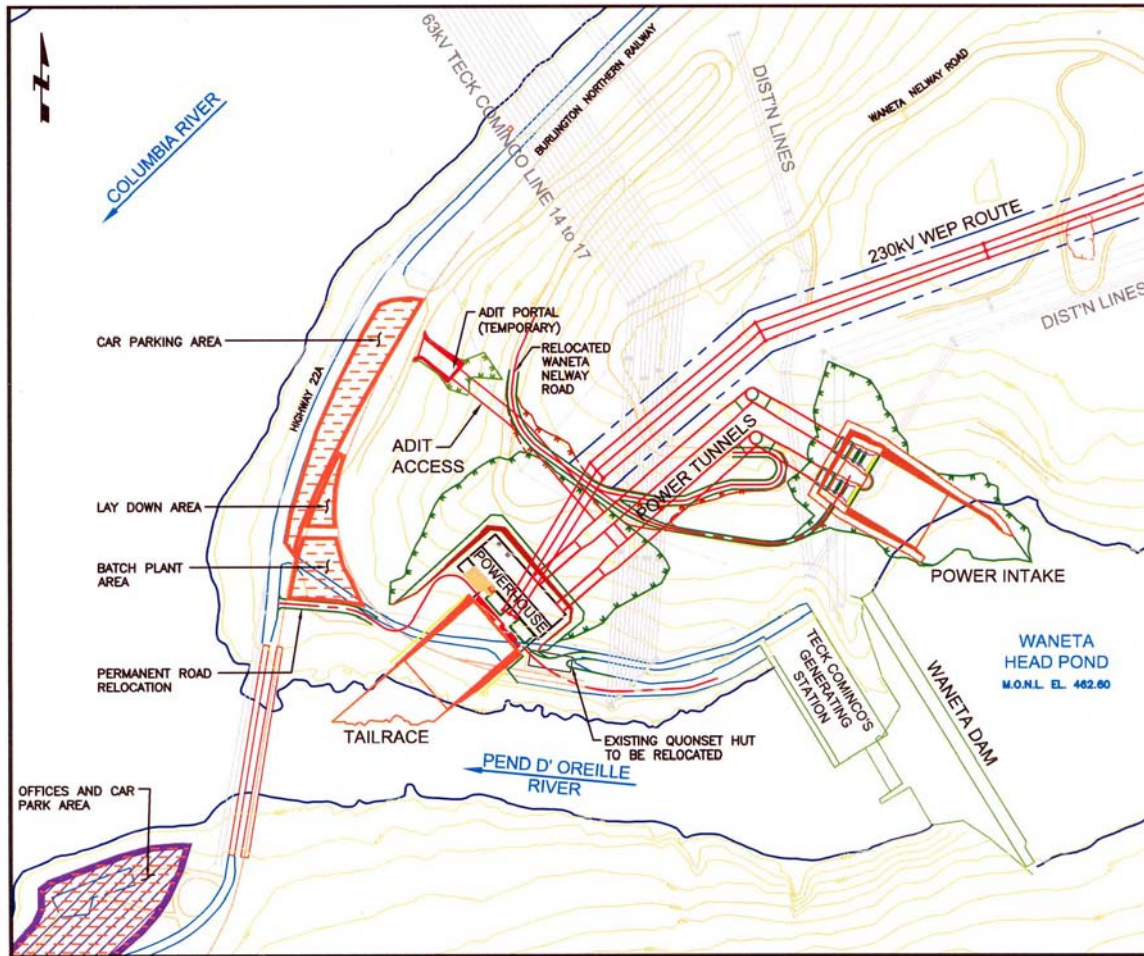




# CPC/CBT Rights

- Teck Cominco has existing licenses for the first 708 cms
- Expansion Rights purchase by CPC from Cominco in 1994
- Water license application for 765 cms
- Teck Cominco has applied for a license for additional 224 cms for Upgrades to existing plant (3<sup>rd</sup> priority)
- Proponent a Joint Venture between Columbia Power & Columbia Basin Trust

# Base Concept – up to 435 MW



- Two intakes on the right bank of Waneta headpond
- Twin power tunnels
- Surface powerhouse with two Francis units
- Two transformers on downstream side of powerhouse
- 230 kV gas-insulated switchgear between transformers
- 230 kV single circuit line from powerhouse to point of interconnection at BC Hydro's Selkirk Substation

# Key Assessment Issues

- Contaminated sediments in the intake area
- Flow changes to the Waneta Eddy
- Fish entrainment
- Load shaping
- Total dissolved gas (benefit)

# Confluence of the Pend d'Oreille and Columbia Rivers



## Confluence of the Pend d'Oreille and Columbia Rivers

- main channel of the Columbia River to the right side of the river channel
- a deep hole between the main channel of the Columbia River and the discharge from the Pend d'Oreille River (Waneta Eddy)
- a gravel bar upstream from the confluence and Waneta Eddy
- supercritical flows from the Pend d'Oreille River with large standing waves downstream from the bridges

## White sturgeon habitat

- Waneta Eddy is an important habitat for staging, feeding and overwintering by white sturgeon
- Only known spawning site for this population of white sturgeon

# Schedule Target Dates

Submit draft terms of reference for EA	Sept. 2003
Public review period	Oct – Nov 2003
Submit final terms of reference for EA	April 2004
Terms of Reference approved	May 2004
Submit EA Certificate Application (EACA)	Spring 2005
Regulatory decision on the EACA	Fall 2005
Award Design-Build Contract	2006/07
Complete Interconnection	2009/10
Commercial Operation	2010/11



# TGP Benefits

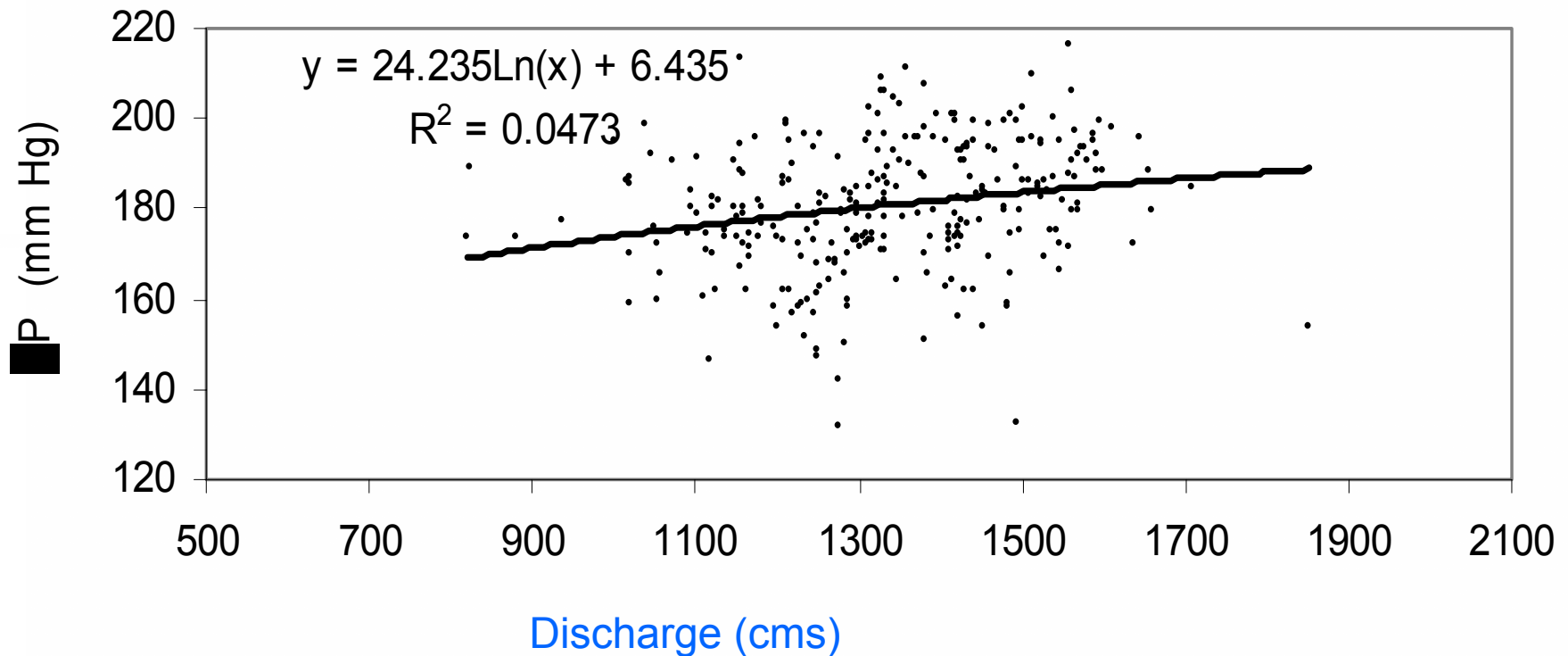
- The Waneta Expansion Project will increase the generation capacity at Waneta Dam.
- This increased capacity will allow the use of a portion of the water that is presently spilled at the dam to produce additional electrical power.
- This also will reduce the levels of TGP that are produced at the dam during periods of spill, which will result in benefits to the downstream aquatic environment.

# 2004 TGP Study Objectives

- Determine the current contribution of TGP from Waneta operations
- Determine the likely decrease in TGP from the Waneta expansion
- Determine optimum operations of spillways at Waneta dam in the further reduction of TGP at Waneta

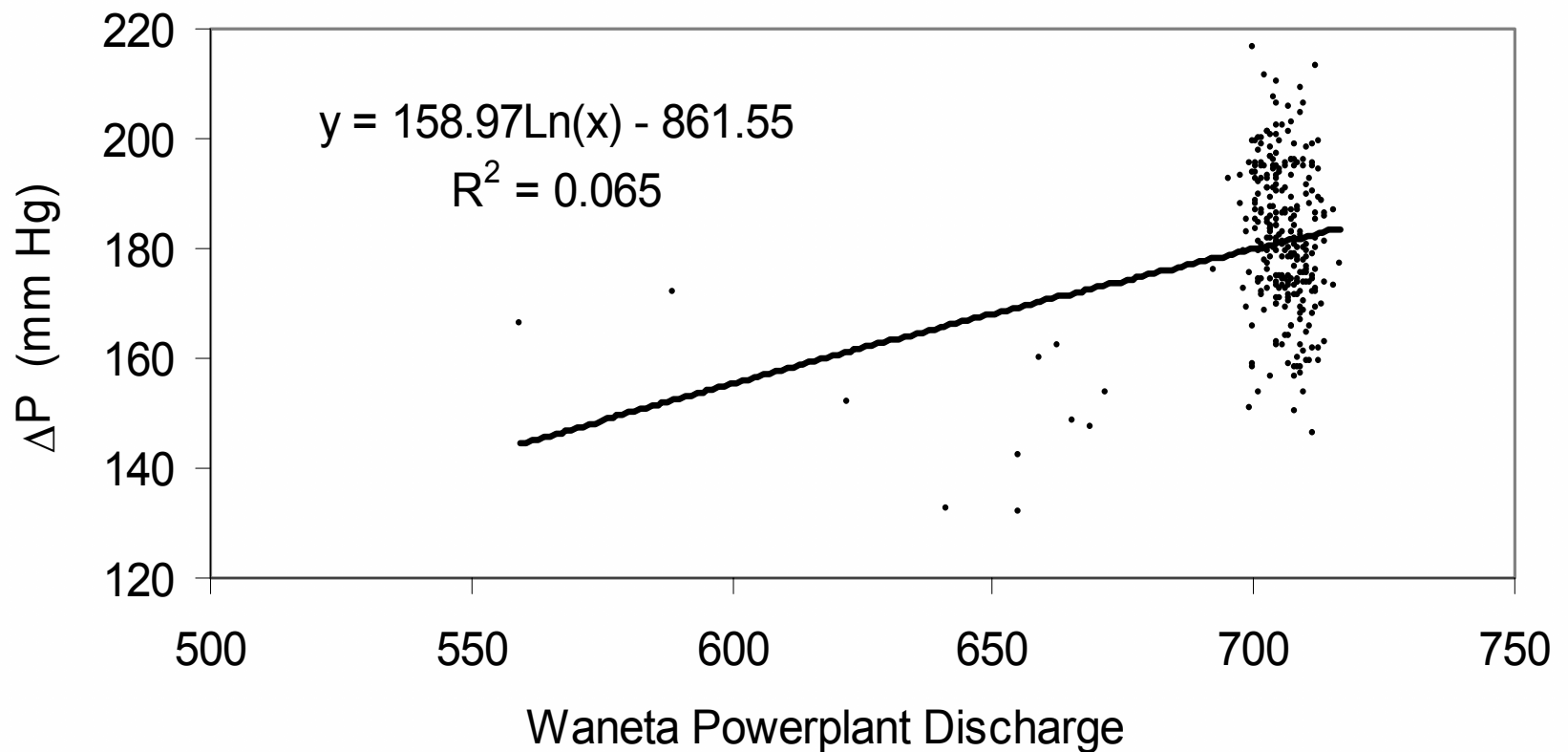
# Past TGP Modeling Efforts

- Mass balance approach
- Accurately modeling of TGP difficult due to the mixing zone of the powerplant plume with the spillway plumes.
- Based on temperature data, Pend d'Oreille flows at the CIBW station on the US border may not be completely mixed with the Columbia flows.
- Current mass balance equations may be in error and may under or overpredict TGP entering the US.



The calculated  $\Delta P$  of the water discharged from Waneta Dam spillways plotted as a function of spillway discharge (based on monitoring efforts in 1999). The regression line is a log plot indicating possible relationship of  $\Delta P$  to spillway discharge. Large scatter may be caused by violation of mass balance assumptions (complete mixing with the Columbia may not occur). The coefficients indicated are used in the current model.



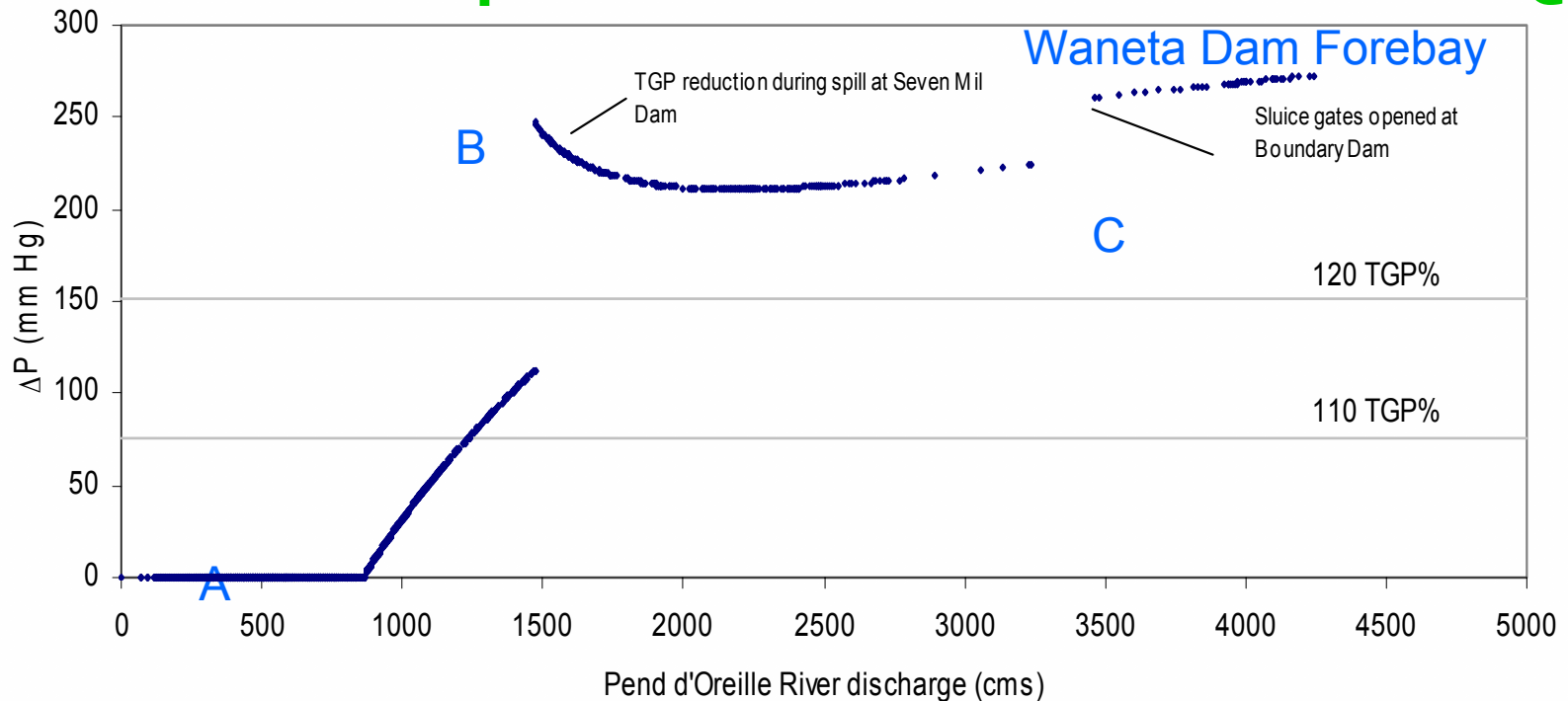


**The calculated  $\Delta P$  of the water discharged from Waneta Dam spillways plotted as a function of Waneta powerplant discharge** (based on 1999 monitoring efforts). The regression line is a log plot indicating possible relationship of  $\Delta P$  to powerplant discharge. This relationship supports the speculation that the downstream CIBW monitoring station may not accurately reflect a mixture of Columbia River and Pend d'Oreille River waters, as powerplant discharge should not affect spill TGP but may affect mixing zone downstream.

# Previous Mass Balance Estimates of US Border TGP

- Based on empirical models of TGP versus powerplant and spillway discharge for Boundary, Seven-Mile and Waneta Dams
- Boundary forebay (Box Canyon tailrace) based on limited relationship of total Q to TGP
- Seven-mile equations predict TGP stripping based on forebay TGP and spill volume
- Sluiceways and Spillways at Boundary are assumed to entrain TGP into powerplant flows.
- Waneta spillway TGP predictions are very weak with large errors

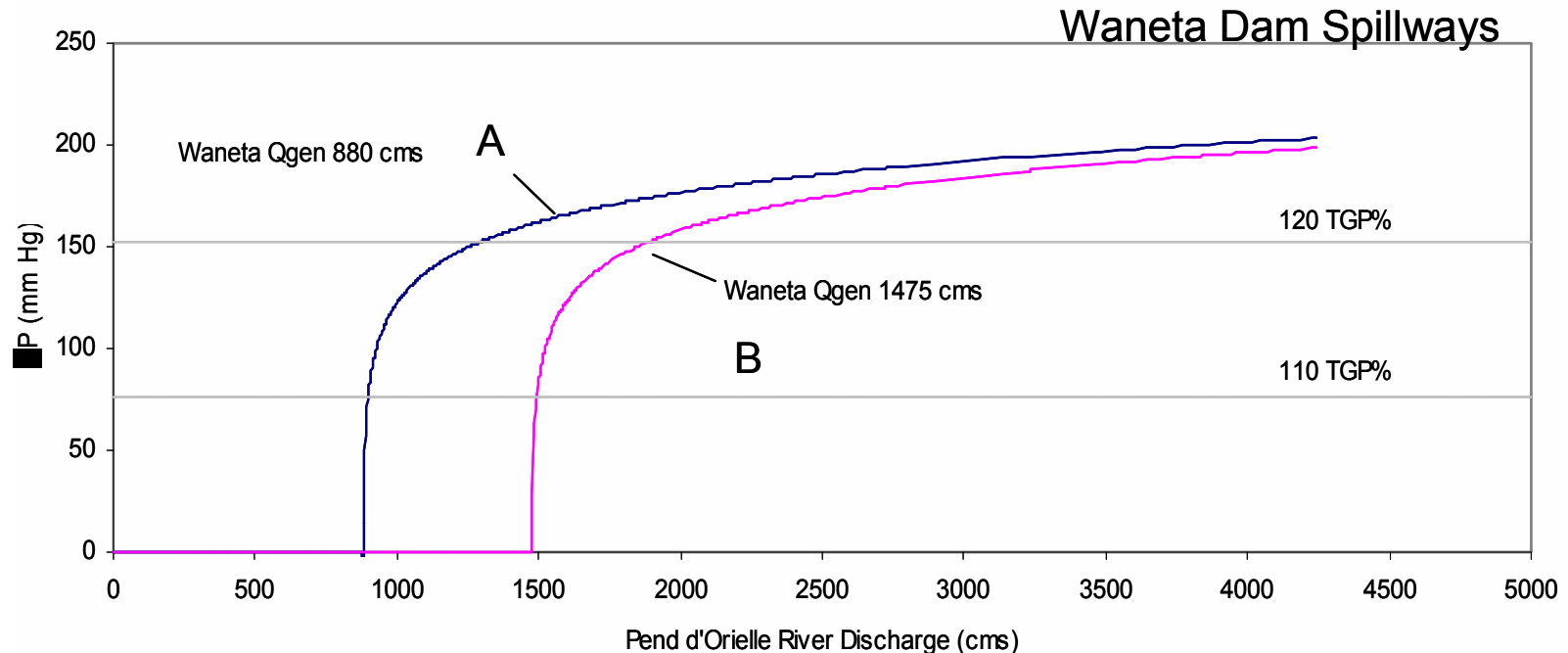
# Waneta Dam Forebay TGP: Relationship to Pend d'Oreille Q



Waneta Dam forebay TGP levels in relation to commencement of spill at Box Canyon Dam (A), Boundary and Seven Mile Dam (B), and activation of mid-level sluice gates at Boundary Dam (C). Spill from Seven Mile Dam reduces TGP levels due to spillway design that promotes gas dissipation. High forebay TGP reduced Waneta TGP reduction potential to flows less than 1400 cms.

# Waneta Dam Spillway TGP:

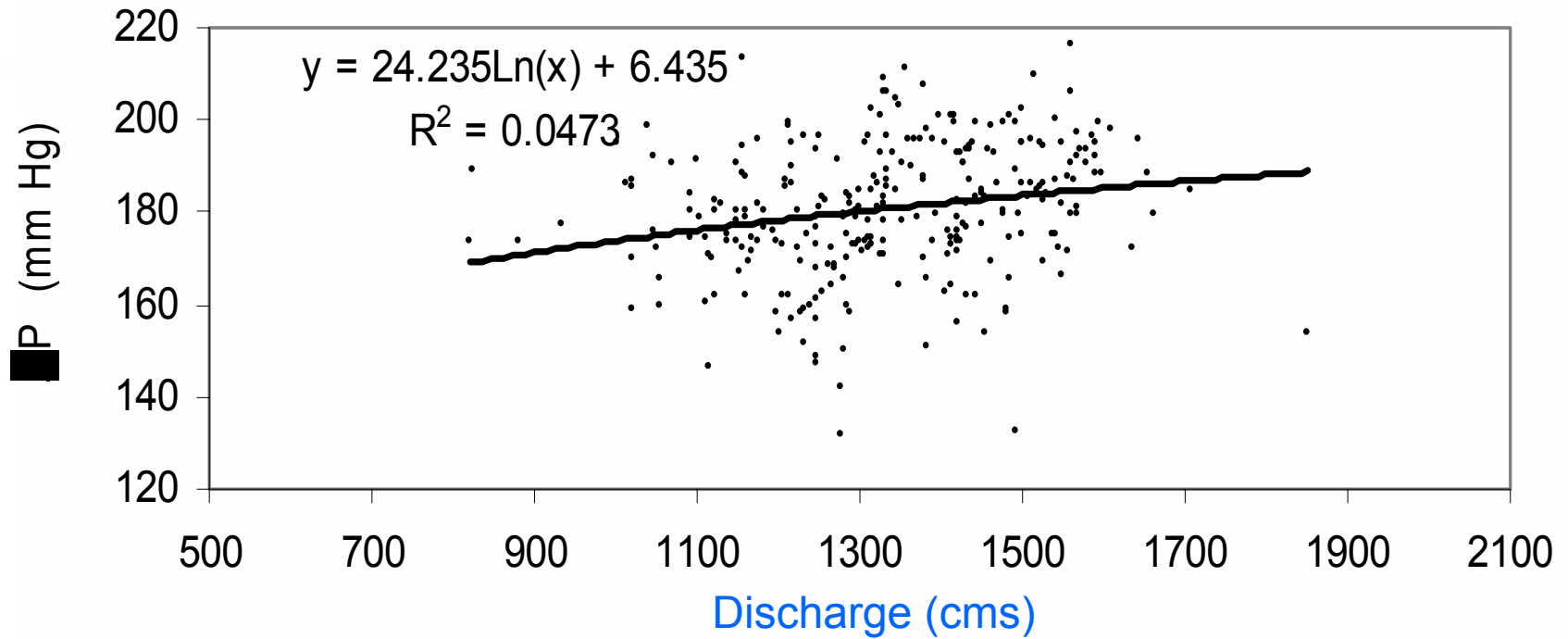
## Preliminary prediction of TGP reduction potential from Waneta Expansion Project



A comparison of Waneta Dam spillway TGP levels in relation to total plant discharge after completion of all turbine upgrades (A) and construction of the Waneta Expansion Plant (B).

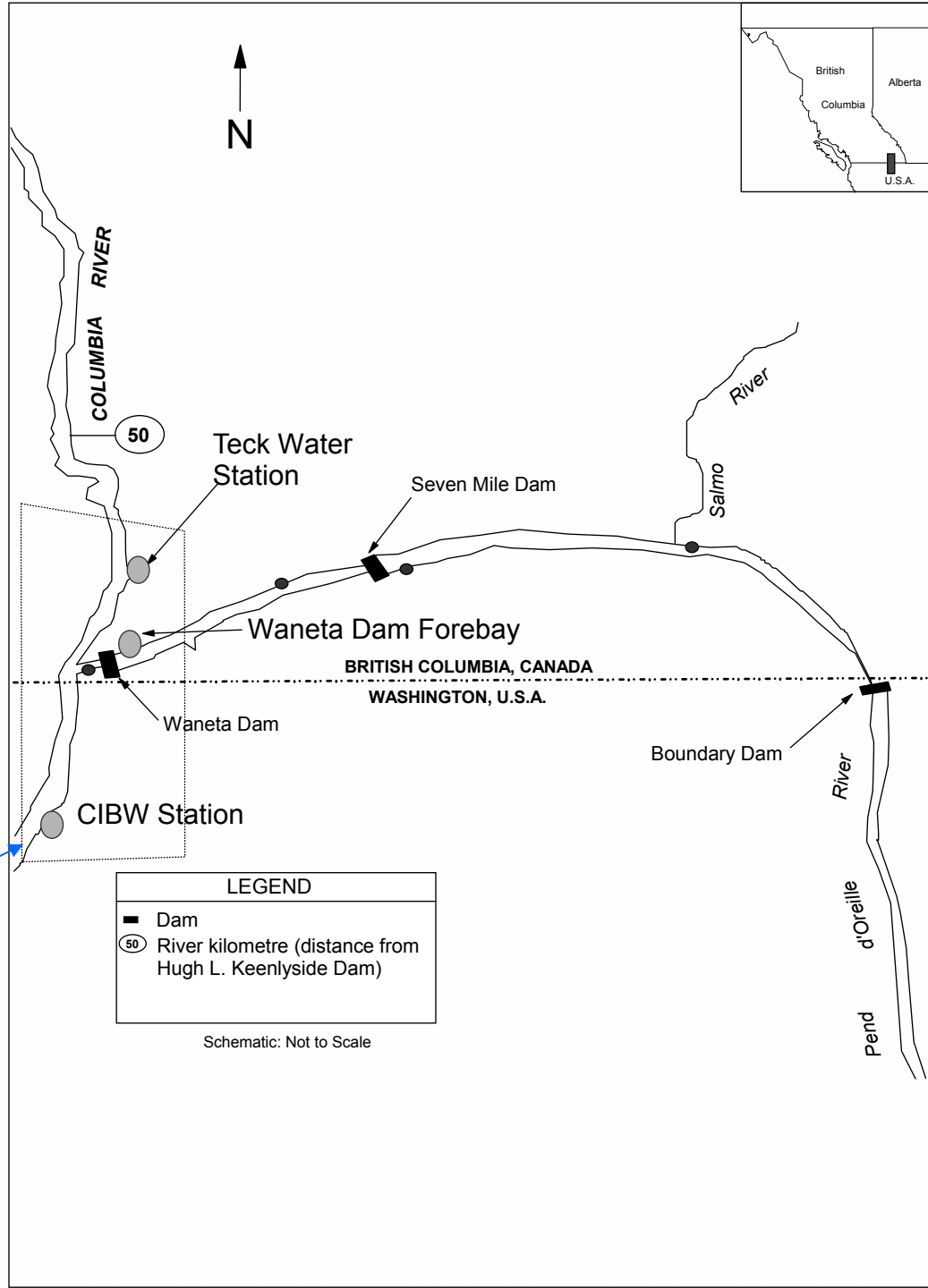
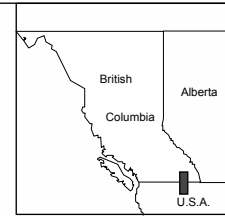


# Basis of Waneta TGP Predictions



# 2004 Methodology

- Install continuous monitoring station at the following locations:
  - Teck Water Station (Columbia River)
  - Waneta Dam Forebay (Pend d'Oreille River)
  - Downstream of CIBW station at location where complete mixing of Columbia and Pend d'Oreille river occurs
    - Verified by TGP cross sections



West Bank  
New TGP  
Station

# Data to be Collected

- Barometric Pressure (BAR)
- Total Pressure (Pt)
- Water Temperature (T)
- Dissolved Oxygen (pO<sub>2</sub>)
- Derived Parameters
  - $\Delta P = Pt - BAR$
  - $TGP\% = (Pt - BAR) / BAR \times 100$



# QA/QC

- Biweekly calibration and data download
  - To minimize data loss
- Comparison of station reading with two calibrated portable TGP meters
- Conduct cross sections at downstream station over a range of flows
  - Assess mixing assumptions and TGP uniformity
- Compare data to State of Washington Dept of Ecology MQO and calculate RMSE's

# 2004 Modeling Efforts

- Mass balance approach
- TGP data recorded downstream of the mixing zone between the Columbia and Pend d'Oreille Rivers will be incorporated into the model. Cross sections of the river will be sampled at current CIBW site and downstream to the new site.
- Once data collection QA/QC is established, spillway gate operations will be varied during the monitoring program to ascertain what operations are most beneficial for TGP reduction.

# Collaborations

- Assist Environment Canada in establishing a viable long-term monitoring station at the Teck-Cominco Water Station
- CRIEMP participation

# Cross Boundary Issue Discussion

Detailed near field study at Waneta needed?

Mass balance model, if properly calibrated, will predict TGP levels entering the US at Lake Roosevelt

Spillway TGP (highest possible) will be used to predict exposure of emerging sturgeon since they occur in the mixing zone

Operational optimums can be determined from mass balance if assumptions are correct

Conclusion, No biological or regulatory value is achieved from such detailed studies.

Compliance with TMDL 110% level at US border.

Not likely possible even if all dams in Canada were removed as the Kootenay River Falls at Lower Bonnington produces TGP in excess of 118%

Cabinet Gorge, Noxon Rapids, Box Canyon and Boundary all exceed this standard resulting in TGP levels entering Canada from the Pend d'Oreille frequently exceed standard

HLK forebay frequently exceeds 110% because of thermal effects

Waneta Expansion will bring this plant into hydraulic balance with Boundary Dam; When flows are above this level, forebay levels may exceed Waneta Spillway TGP formation potential and Waneta spills may result in stripping.